Small Farms Research News

USDA, ARS, SPA Summer 2001 1st Edition

Current Agroforestry Research

Production of No-Input Forage as Affected by Loblolly Pine Spacing

Agroforestry is a relatively new agricultural system for US landowners. Research is needed on optimal tree spacing, site fertilization, and productivity of pine tree stands and understory forage in open pastures. Pines often are planted on poorer, less fertile sites and neither the pines nor the forage may receive adequate fertilization. Lack of adequate fertilization reduces the growth of pines and improved forages, but unimproved range may not respond well to fertilization. Some summer weeds and grasses in unimproved range can provide livestock with acceptable or even higher quality forage than pearl millet and bermudagrass.

Since optimal pine spacing and forage fertilization needs are management objective-driven and site specific, one recommendation will not fit all needs. There is uncertainty of the extent to which forage yield and quality are affected by tree spacing. Growers need more information to be able to match silvopasture design and management with their own conditions and budget.

A study is nearing completion in which baseline information was collected on yield and quality of no-input forage produced under several tree spacing designs. Trees were planted in 1994 and there was no fertilizer application since then. Plots were located in the middle of tree alleys that were 8' to 48' wide, and open (no trees). Tall fescue was an important forage component only in the spring harvests, while panicum, foxtail, and bermudagrass predominated in fall harvests. Forage yield increased from 8', 12', to 16' alleys, but did not change significantly among 16' to 48' alleys or in the open. The relationship between alley width and yield was similar to that between alley width and amount of shade. Alleys 32' and wider received full sun, while 8' alleys received only about 45% sunlight. While yield and sunlight reception were related to tree spacing, we cannot say at this point that shade was the only factor governing yield. Soil moisture, which we did not measure, also could have affected yield at high tree densities.

We found that forage in 8' alleys was highest in crude protein (9.6%) and decreased to about 8% in the open. However, the higher protein was more than offset by the very low yield at this spacing. NDF, an estimate of intake, indicated that forage was comparable to bermudagrass, but ADF, an estimate of digestibility, was poorer than bermudagrass (Table 1). Forage nutrient and mineral levels were generally adequate for maintaining beef cattle, except for crude protein and sodium. Phosphorus was marginally adequate.

Forage yield averaged about 2,500 lb/A per year. This yield was very poor compared to adjacent fertilized plots containing tall fescue and bermudagrass that yielded about 10,000 lb/A, showing the benefit of pasture fertilization. But the yield was about twice that of native grasses and common bermudagrass in Louisiana under 22-yr-old loblolly pine. The yield data confirmed that 16' alleys were the minimally acceptable width for forage production and equipment access at this stage of tree growth. As the trees grow they will need to be thinned to prevent forage growth from being overly reduced by competition with trees, and pruned to produce quality sawlogs.

Table 1. Average nutrient levels in no-input, unimproved forage produced under loblolly pine in 1999 and 2000.

Forage nutrient	Amount	Beef cattle needs[1]
Calcium	0.49 %	0.19 %
Protein	8.4	9.1
Fiber - ADF	44	32[2]
Fiber - NDF	72	72[2]
Magnesium	0.29	0.10
Phosphorus	0.13	0.13
Potassium	0.97	0.60
Sodium	0.02	0.06-0.08

[1] Maintenance level (National Research Council, 1996). [2] Typical levels for bermudagrass (University of Arkansas, 2000).

For additional information contact Dave Burner or Dave Brauer at DBSFRC.

Productivity of Tall Fescue and Orchardgrass Under Loblolly and Shortleaf Pine

In this region, tall fescue is the cool-season grass of choice for agroforestry applications because of its widespread use in more conventional agricultural applications, and its shade tolerance. There has been relatively little research, however, on other grasses that might also be productive in the shade. Orchardgrass is one possible replacement for tall fescue for a number of reasons. As its name suggests, orchardgrass grows well under trees. Its regrowth has higher nutritive value than tall fescue, it lacks the fescue toxicosis problems associated with the tall fescue endophyte, and it is highly responsive and competitive when fertilized. Further, orchardgrass grows well in this area, is a preferred forage by cattle, and many producers are familiar with it.

We are conducting research to compare the productivity of 'Potomac' orchardgrass, 'Kentucky 31' tall fescue, and a 50-50 mixture of the two grasses grown under loblolly and shortleaf pine, and in the open. Trees were planted in 1992 and grasses were sown in fall 1999. The study is in its early stages and has been harvested three times. To date, yields of the three grass treatments are nearly equal. However, tall fescue tends to yield more in the open than under trees, while orchardgrass tends to yield well both in the open and under the denser canopy of loblolly pine. Orchardgrass also seems to be more competitive than tall fescue under trees and in the open as it is increasing in the plots. Overall, yield under trees is about 2/3 of yield in the open showing that trees and grasses are competing with one another. Thinning and pruning the trees could open up the canopy and increase forage yield.

Another related study on orchardgrass is being conducted by Center researchers. Loblolly pine was planted at a 5 x 10' spacing (870 trees per acre) in 1997. Ten cultivars of orchardgrass were sown in alleys in fall 1999 to determine whether they differ in persistence during the early stages of a loblolly pine rotation. Plots are largely unshaded and have been cut three times. Yields have been excellent, averaging as much as 1,800 lb orchardgrass per acre. We anticipate that the yield differences between cultivars will be even greater once the trees and grass become more competitive.

Table 2. Yield of orchardgrass cultivars in alleys of young loblolly pine

	Orchardgrass yield[1]				
Cultivar	Cut 1	Cut 2	Cut 3	Total	Average
	lb dry matter/A				
Baridana	1,209	1,326	2,079	4,614	1,538 ab[2]
Benchmark	1,201	1,848	2,159	5,208	1,736 a
Boone	1,747	1,529	2,239	5,516	1,838 a
Bronc	966	1,159	1,475	3,560	1,200 bc
Hallmark	1,252	1,444	1,932	4,628	1,543 ab
Hawkeye	613	1,238	1,663	3,515	1,172 c
Justus	886	1,160	1,701	3,747	1,249 bc
Potomac	1,388	1,830	1,988	5,206	1,735 a
Renegade	1,159	1,722	1,610	4,491	1,497 abc
Tekapo	1,533	1,261	2,114	4,908	1,636 a
Average	1,196	1,452	1,896	4,539	1,514

[1] Cuts were 11/17/00 (cut 1), 5/1/01 (cut 2), and 6/12/01(cut 3).
[2] Averages followed by a common letter do not differ significantly ($P<0.05$).

For additional information contact Dave Burner at DBSFRC.

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Ice Damage to Pine Stands

An ice (glaze) storm struck northeast Texas and east central and southwest Arkansas on Christmas day, 2000. The storm was historically significant because of the heavy ice accumulation (estimates of as much as 1" accumulation in some places) and widespread devastation (315,000 Arkansans lost power). The Arkansas Forestry Commission estimated that 68,000 acres of private, nonindustrial forest land suffered complete timber loss estimated at $50 million or more. During the storm, freezing rain accumulated to such an extent that tree branches, tops, or trunks bent severely or broke.

Ice damage is frequently assessed but, since every storm event is unique, damage can differ considerably due to storm characteristics and severity, geography, and tree species, age, spacing, management, and health. We were fortunate in that there was no significant wind associated with this storm, which would have made the damage much more severe than it was. In a storm-affected stand the damage to individual trees can range from none to total loss, with all stages in between. We are assessing the ice damage suffered by pine trees on the Center and in two pine stands on Rogers Scout Reservation. Trees represented four age classes and most were at pre-commercial stages of growth where pulpwood salvage would not be possible.

Four-yr-old loblolly pine suffered almost no permanent damage. Seven-yr-old trees were in 1 A blocks ranging from 228 to 1,380 trees per acre (TPA). While many published reports indicated that amount of ice damage is not related to tree spacing, we found that trees suffered more breakage to the lower 75% of the tree truck in more open stands. There tended to be more straight trees and fewer severely bent ones in narrow alleys. We are monitoring the recovery of 40 selected trees having different amounts of trunk bending.

Nine-yr-old loblolly and shortleaf pines were rated only for breakage. Both pine species had about 1/3 breakage. Based on sunlight readings done in 2000 and 2001, the ice storm did not appear to have opened up this stand. Differences in ice damage between two 18-yr-old stands having about 50 and 980 TPA were due to thinning that occurred within the past five years. The thinned stand had fewer undamaged trees, more severely leaning and bent trees, and more broken trunks.

Another 7-yr-old stand having an initial density of 680 TPA (4' x 16' spacing) was thinned to two densities, 250 or 500 TPA, following the storm by removing broken and severely bent trees. Thinning to 250 TPA resulted in removal of most severely damaged trees, while some bent trees remained at 500 TPA. Thus, while a stand may appear at first glance to be damaged beyond repair, there may be enough sound trees to recover a commercial stand. Further, some trees that are bent or have broken tops may actually yield a marketable product later in the rotation. Our data suggest that it may be preferable to plant pines at relatively close spacing, 4' x 16' for example, so that if an ice storm occurs early in the rotation there should be enough undamaged trees to obtain a reasonably well-stocked stand.

For additional information contact Dave Burner or Adrian Ares at DBSFRC.

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From a Pasture to a Silvopasture System

(by J.L. Robinson and T. Clason, AF Note 22, National Agroforestry Center, Dec. 2000).

Research has demonstrated that, if managed properly, forage production can be maintained in a silvopasture system while producing high value timber and livestock. Pines have been found to be compatible with forage production and livestock grazing when properly managed. This article provides options for establishing pines in existing pasture systems for the production and management of both forest and forage products. The following are planning considerations to convert from pasture to silvopasture:

Soils

Determine the soil suitability of the area for establishing pine trees. If the soil is not suited to pine species do not convert from pasture.

Tree Planting

Determine the desired row spacing for the pine planting. Planting rates from 100 to 400 TPA are typically recommended for planting a silvopasture system. Trees may be grown in single rows or in aggregate rows called sets with wide alleys for forage production between sets.

Planting arrangement should consider management objectives, equipment operation, adequate growing space until the first tree harvest, and companion-forage species needs. The desired establishment density is, in part, determined by the existing markets for timber products. Higher planting densities will require the removal of smaller diameter trees to prevent canopy closure. If readily available markets for small round wood exist then the higher planting densities are feasible options. If such markets don't exist, the lower planting densities have the advantage of reducing the need for non-commercial thinning.

On sloping land, rows should be oriented on the contour to prevent soil erosion within the tree rows during establishment.

Site Preparation and Establishment

Determine site preparation needs. Apply a herbicide or till a strip 2 to 4' wide for each row to be planted. If the soil has a compacted layer, rip or subsoil along the planting rows. This improves the ease of planting and improves rooting conditions for young seedlings, thus ensuring better survival and growth. In some areas, a prescribed burn or pesticide treatment may be needed to control rodents prior to tree planting. Follow-up applications of selective herbicides for two to three years may aid tree establishment. Follow locally approved tree planting practices for tree establishment.

Tree Management

Determine the tree management needs.

● Thinning. Trees generally have little impact on forage production until shading becomes dense enough to limit sunlight to the understory. Thinning of trees is scheduled to reduce canopy shade and tree competition for understory forage production. When the trees' combined canopy exceeds 35 to 45%, forage production of warm-season grasses begins to decline. Continuous observation is important in making adjustment to the management strategy. For cool-season grasses, shade tolerance of some species may exceed 60% and still produce good forage yields. Depending upon the species of grass, tree thinning needs to be conducted to keep canopy cover below the maximum shade tolerance level. With proper establishment densities the first thinning should be planned around 10 to 15 years of age for pulp or small round wood. Successive thinnings can be scheduled about every five years until final harvest at approximately 30 to 45 years. This schedule will vary some depending upon the productivity of the site, the species of tree, and the targeted, final wood products.

● Pruning. Widely spaced trees delay tree canopy closure benefitting forage crops but the "open grown" trees may develop large branches that can reduce wood quality if trees are not pruned. The object of pruning is to confine the knots created by these branches to a small diameter (four inches) of core wood thereby producing high quality, knot free wood on the outer diameter of the tree stem.

❍ Pruning should be initiated when the crop trees reach 15 to 20' and/or the stump diameter reaches 5" at a height 6" above the ground.

❍ Pruning should strive to remove all of the branches where the trunk diameter is greater than four inches. But, never remove more than 50% of the live canopy.

❍ Pruning operations should be scheduled periodically until the tree bole is pruned up to 18'. Each successive pruning operation proceeds up the main tree stem to a 4" diameter core but removes no more than 1/3 to 1/2 of the total crown while maintaining a live crown equal to 1/3 of the tree height.

❍ Pruning operations continue until a 18' knot-free log is developed. Follow local guidelines from the state forestry agency, NRCS, or extension service for proper pruning techniques.

Grazing Management

Very young trees are subject to browsing or trampling by livestock. Grazing should be restricted or excluded during the first two to three years after establishment or until the terminal bud of the trees is above the reach of livestock (6 to 8'). Forage produced during these years can still be mechanically harvested and utilized for hay. Once the terminal bud of the trees is above the grazing

height of livestock, grazing can proceed without damage to the trees. If heavy browsing is observed there may be a deficiency in the livestock diet. Pines are not typically browsed by livestock when adequate quality forage is available.

As with any managed grazing system, soil amendments should be applied as needed to maintain desired forage production levels. An added benefit is that stem production of wood has been shown to increase by 20 to 30% in response to fertilizer management for forage production.

Continuous grazing is not recommended for silvopasture systems. A planned grazing system in which multi-grazing units are rested and grazed in a planned sequence should be developed. The grazing management plan should maintain an adequate balance between livestock numbers and forage production. Close monitoring of forage, livestock, and timber performance will provide economic and environmental benefits attainable through silvopasture systems.

For additional information contact the National Agroforestry Center (NAC), East-Campus-UNL, Lincoln, NE 68583-0822. Phone: 402/437-5178; web site: *www.unl.edu/nac.*

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Commentary:

Center's First Field Day in Recent Years

The Center held its first field day in several years on June 2, 2001. One of the reasons the Center has not had a field day recently is that most of the Center's scientists have been here less than three years. It takes at least three years for a field research project to progress from conception to a point when a scientist has something definite to say about the results. Results must be made available to farmers and ranchers for the Center's research to have impact on agriculture. An annual field day is one tool that the Center is using to inform farmers of research results.

My goals for this first field day were three-fold: 1) to provide the local public the opportunity to visit; 2) to provide an opportunity for local farmers and ranchers to learn about the Center's research program; 3) to promote the activities of the Center's partners and cooperators. My objectives for goals 1 and 2 were to give attendees a glimpse of the projects being conducted at the Center rather than an exhaustive report. The topics for the field day were: 1) Overview of NRCS/ Plant Material Center activities; 2) Hardwood-based agroforestry systems; 3) Evaluation of hair sheep breeds for meat production; 4) Grazing studies for enhancing stocker cattle production; 5) Pine-based agroforestry systems; and 6) Incorporating poultry litter into pastures. It was our hope that brief project reports would spark interest leading to invitations to address interested groups or to develop more specific, more detailed programs later in the year. One weakness that I see now in the program that was presented on June 2 was the Center did not present results from its current research program related to cow-calf production. Many of the local farmers engage in cow-calf operations and thus were not made aware of our efforts in this area.

The Center has many off-site cooperators. Most of the Center's partners and cooperators attended the field day and brought displays explaining their research projects. I appreciate their attendance. Their presence demonstrated that the Center's activities impact not just Logan County, Arkansas, but also adjacent states.

Approximately 130 people from various points throughout Arkansas and 2 from the state of Oregon attended the field day. Attendees varied greatly in their background from local town people to people traveling through the area who wanted to hear Representative Asa Hutchinson speak (Representative Hutchinson recently was nominated by President Bush to be the chief of the Drug Enforcement agency, DEA). To all of those who attended: thank you for your time and interest. If you have comments regarding the field day, please pass them on to me using the contact information found in this newsletter.

Very early in planning for the field day, I decided to invite Representative Hutchinson to be the featured lunch time speaker. Representative Hutchinson has been a strong supporter of the Center, and of agricultural research and education during his years in the House. The Center has appreciated his support over the years. After the field day, it was related to me that some people did not attend because Representative Hutchinson was the featured speaker. The feeling being expressed was that Representative Hutchinson's prominent role made the field day more of a political rally than an event for the general public and/or farmers. The field day was never intended to be a political rally. The Center was committed to holding the field day

months prior to the time that Representative Hutchinson agreed to speak. Representatives and Senators are important to the continued presence and growth of the Center. Therefore, it is important to us at the Center that they visit. Representatives and Senators are more likely to visit the Center in conjunction with a public event, like a field day. The presence of an elected official at any field day is not an endorsement of a political party, candidate. etc. Three of the four Representatives and both Senators and/or their staffs were invited to attend the field day. How widespread and deep this concern regarding the presence of elected officials at a field day is not known to me. If you have concerns, I would appreciate hearing your comments. The attendance of elected officials was commonplace at most field days I attended while growing up in Delaware.

Again thank you for attending and/or participating in the June 2 field day. Also I want to express my thanks to the Booneville School District, Booneville Industrial Development Corporation, and the USDA committee of the Booneville Chamber of Commerce for their help and support in making the field day a success.

For additional information contact Dave Brauer at DBSFRC.

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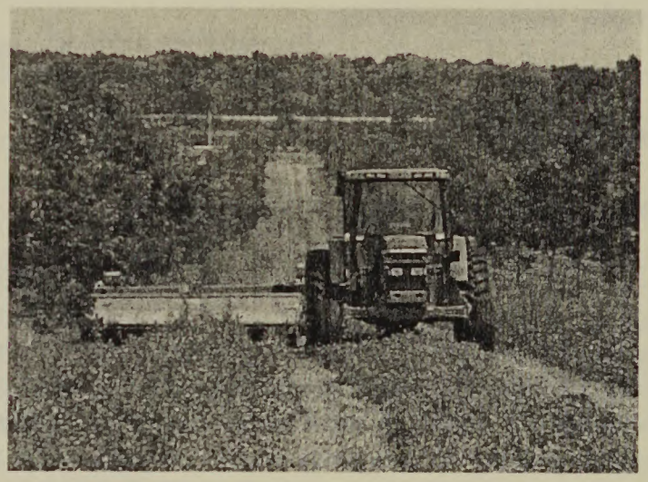
Trees + Agriculture = Agroforestry! A winning combination

Some farmers have expressed amazement that anyone would want to put trees in their agricultural fields. "After all", they say "my daddy and grand-daddy spent a lot of time clearing trees out of the fields!" Yet more and more farmers are implementing farming practices involving trees. These are called agroforestry and they combine traditional agriculture and forestry practices in an integrated, mutually beneficial land use.

Agroforestry is well known in many parts of the world and is beginning to take hold in the United States. Simply defined, agroforestry combines trees with crops and/or livestock for diversifying farm income and providing conservation benefits. There are five agroforestry practices used in temperate zones. Alley cropping combines rows of trees with crops grown in the alley ways between the trees. Riparian forest buffers, a combination of trees, shrubs, and grasses, are established on streams and river banks. Their purpose is to enhance bio-diversity, to prevent erosion of streambanks and to protect the water resource from pollution. Trees are combined with pastures and livestock for silvopasture agroforestry. Windbreaks and shelterbelts, where trees protect soils, crops, and livestock from the wind, are also considered an agroforestry practice. Finally, even existing forest stands can be used in forest farming. High value specialty crops such as ginseng, goldenseal, and mushrooms are cultivated under the protection of a forest canopy that has been modified to provide the right amount of shade.

There are a variety of benefits provided by agroforestry such as improved crop production, greater economic gain, improved soil and water quality, and increasing biodiversity in agricultural landscapes. Wildlife habitat can be enhanced if that is a goal and insect populations can be controlled in a more biologically-sound manner. A recent study has shown that the number of damaging insects decreased in an alfalfa - walnut alley cropping system.



Harvesting hay in an agroforestry alley cropping system with pecans.

The landowner's goals determine the type of agroforestry practice that is implemented. In alleycropping, a landowner can gain income from a nut crop such as walnuts and later harvest the timber. To gain higher annual income while waiting for the tree to produce nuts, some landowners are planting high value crops in the tree alleys, such as medicinal plants or crops like wild flowers which yield profitable seeds. A silvopasture practice will yield annual income from livestock production.

Riparian forest buffers and windbreaks can be specially designed to provide income and yield products which can be sold in the horticulture market or so that lease hunting can take place.

While many farmers are inquisitive of agroforestry practices, some are hesitant to try them citing lack of knowledge about trees, concern over the longer time horizon to gain income, and a concern that trees may interfere with their agricultural equipment. However, as more natural resource professionals are trained in agroforestry and more information is made available to landowners, these concerns are addressed so that landowners feel more comfortable using these practices, both for more diversity on their farms and to realize their conservation benefits!

For additional information contact Dr. Sandra S. Hodge, Director of Technology Transfer and Outreach Unit, University of Missouri Center for Agroforestry, 203 ABNR, Columbia, MO 65203. Phone: 573/884-2874; Email: umca@missouri.edu

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Dale Bumpers Small Farms Research Center is a partnership among three institutions:

ARS- conducts research related to livestock production and agroforestry; ARS staff can be reached at 501-675-3834.

PMC/NRCS- evaluation of vegetation and vegetation technology to retain soil and its productive capability; NRCS staff can be reached at 501-675-5182.

Division of Agriculture / University of Arkansas- dissemination of agricultural information. Extension Specialist, Billy Moore, can be reached at 501-675-5585.

ARS scientists at DBSFRC and their primary research focus:

David Brauer- Agronomist/Research Leader investigating both agroforestry and livestock production

Glen Aiken- Agronomist investigating production practices for stockers

Adrian Ares- Forester working on tree growth and physiology in agroforestry systems

David Burner- Agronomist investigating crop production in agroforestry systems

Joan Burke- Animal Scientist investigating reproductive performance in cattle and production practices for hair sheep

Dan Pote- Soil Scientist investigating the effects of management practices on sediment and nutrient retention in agroforestry and livestock production systems

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Organizations promoting agriculture in the Ozark Region

The information below is not an exhaustive list of organizations trying to help farmers and ranchers in the Ozarks. If your organization is interested in being included, please contact David Brauer.

Poultry Production and Product Safety Research Unit (PPPSRU)/ARS/USDA/Center of Excellence for Poultry Science is located on the campus of the University of Arkansas in Fayetteville. PPSRU conducts research to solve problems related to: 1) diseases and physiological disorders that are of economic important to the poultry industry; and 2) land application of waste from the poultry production. PPPSRU can be reached at 501-575-4202 or on the world wide web at www.uark.edu/~usdaars/.

South Central Agricultural Research laboratory (SCARL)/ARS/USDA conducts multi-disciplinary research for developing technologies to establish and sustain production and post harvest quality of alternative crops such as vegetables, small fruits, and kenaf. The Laboratory is co-located with the Oklahoma State University's Wes Watkins Research and Extension Center in Lane, OK. SCARL can be reached by phone at 580-889-7395 or on the world wide web at www.lane-ag.org.

Shirley Community Development Corporation (SCDC) is a community-based organization formed to plan and initiate short- and long-term development programs for Shirley, AR and the surrounding communities. These programs focus on economic development, educational enhancement, youth job training, and service projects that improve and strengthen the community. SCDC is involved in projects that research and demonstrate the skills and techniques needed for production and marketing of specialty agricultural crops. The present focus is on log-grown Shiitake mushrooms. SCDC operates the Shiitake Mushroom Center as a training center. Recent additions include on-site production of garden bricks and stepping stones, raised bed herbal plots, twin wall polycarbonate greenhouse, and compost demonstration project. SCDC can be reached by phone at (501) 723-4443 or on the web at http://www.shiitakecenter.com/index.html.

The Kerr Center for Sustainable Agriculture in Poteau, OK offers leadership and educational programs to those interested in making farming and ranching environmentally friendly, socially equitable, and economically viable. The Kerr Center can be reached by phone at 918-647-9123, by email at mailbox@kerrcenter.com or on the web at www.kerrcenter.com.

ATTRA, Appropriate Technology Transfer for Rural Areas, is the national sustainable agriculture information center. ATTRA provides technical assistance to farmers, Extension agents, market gardeners, agricultural researchers, and other ag professionals. ATTRA is located in Fayetteville, AR. ATTRA staff members prefer to receive requests for information at 800-346-9140. ATTRA maintains a web site at www.attra.org

The Good Grazer Group (GGG) is a network of livestock producers mainly from northwest Arkansas but includes producers from many other states including Virginia, Missouri, and Oklahoma. GGG maintains a electronic mailing list on which members routinely share information and opinions regarding various topics on forage management and livestock production. Members meet monthly, usually at a member's farm, to see and discuss information related to grazing practices. Individuals interested in joining the GGG should contact Ann Wells at annw@ncatark.uark.edu.

Information regarding the ***Arkansas Cooperative Extension Service and the Division of Agriculture*** can be found on the internet at the following web site: www.uaex.edu.

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Attention

Are you interested in a person to speak at a meeting of your civic or agricultural group? If so, please contact David Brauer at 501-675-3834 to see if we can match your interests/needs to the expertise of the Center's staff.

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If you did not receive this newsletter by mail and would like to do so, please contact the Center and we will place you on our mailing list.

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Upcoming Events

August 25, 2001- The Dale Bumpers Small Farms Research Center Sheep Day. Extension activities, ram breeding soundness will be provided.

Registration 8:30
Welcome, Dr. David Brauer, DBSFRC 8:45
Tour of the Facility 9:00
Predator Control, Guy Robson, DBSFRC 10:00
Ram Breeding Soundness 10:30
Future Direction of the Sheep Industry 11:00
Dr. Charles Parker
Scrapie and other Health Issues 11:45
Dr. Dianne Hellwig, Univ. of Arkansas
Lunch 12:15
Hair Sheep Research 01:00
at ARS in Booneville, Dr. Joan Burke, DBSFRC
Marketing of Lamb 01:30
Jim Morgan, Round Mountain Katahdins, Fayetteville
Other potential topics:
Management of a Profitable Sheep Flock
Feeding the Flock
Value Added Products
Katahdin meeting 3:00

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